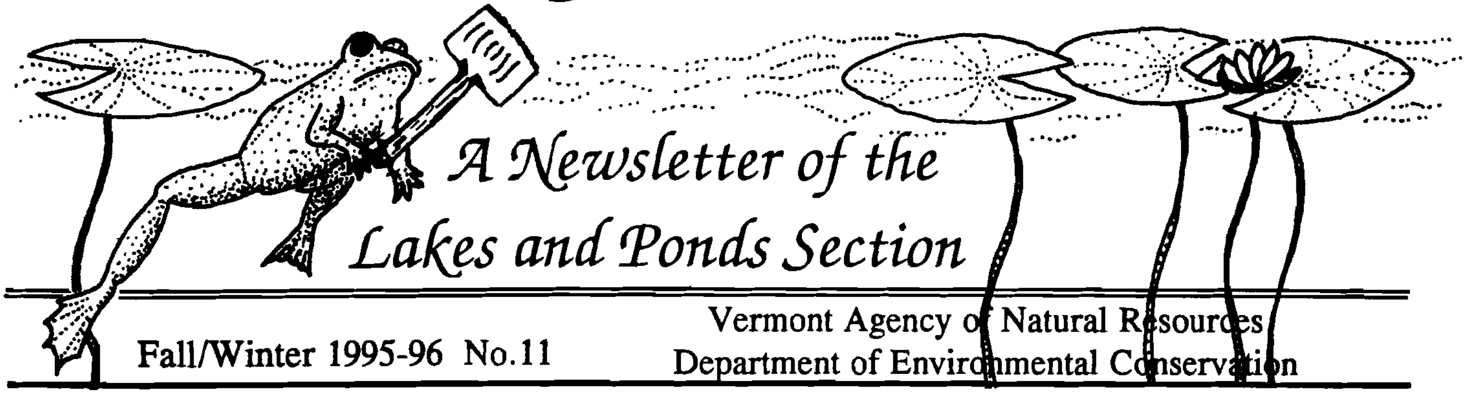
# Out of the Blue



## A Newsletter of the Lakes and Ponds Section

Fall/Winter 1995-96 No.11

Vermont Agency of Natural Resources
Department of Environmental Conservation

## Zebra Mussels: A Threat to Native Mussels

The introduction of zebra mussels into Lake Champlain poses a grave threat to the native mussels of the lake. In 1994, observations of zebra mussel attachments to native mussels were limited to the South Lake. However, by the summer of 1995, native mussels found in southern Lake Champlain had as many as 200 zebra mussels attached to their shells and further north, native mussels near Colchester Point were observed with more than 100 zebra mussels attached to them.

There are 17 species of freshwater mussels native to Vermont waters. The Lake Champlain basin supports 14 of these species, housing the greatest diversity of mussel populations in all of New England. Mussels are invertebrate animals, and, like their clam and snail relatives, have a hard shell that wholly or partly encloses their soft, unsegmented body and a muscular foot used for guiding. Native mussels spend their adult lives situated in the bottom substrates of streams or lakes, filter feeding on algae, diatoms, and plankton from the water column. They play an important role in maintaining the biodiversity of the aquatic ecosystem.

Freshwater mussels are one of the most threatened groups of animals in North America. Nearly half of the 300 native species are extinct, endangered, or in decline. Human activities that have altered river systems and caused increased pollution have led to this situation.

Zebra mussels contribute directly to freshwater mussel mortality by colonizing native

*See "Natives" page 4*

## Why You Should Be Concerned With Road Maintenance!

Do you know what the primary source of pollution to most lakes is? Shoreline septic systems? Boat engines? Actually, its soil erosion! Soil loosened from the ground and transported downhill to the lake carries phosphorus, a naturally occurring nutrient in the soil, to lakes and streams. Phosphorus accumulates in lakes, causing algae blooms, excessive plant growth, reduced water clarity, and dissolved oxygen depletions. The sediment itself clogs stream beds and shallow lake areas, severely affecting fish and wildlife habitat. Soil erosion results from many activities, such as streambank and lakeshore clearing, improperly managed construction sites, and improper road and driveway maintenance.

Good road maintenance is a crucial element in water resource protection, and one that often does not receive the attention it deserves. In many areas, road and driveway erosion appears to be the most significant

*See "Backroads" page 2*

**In This Issue...**

# OUT OF THE BLUE

is produced semi-annually by the Lakes and Ponds Section. Our purpose is to share information on lake environments, water quality and state activities through articles on lake ecology and Section programs. Feel free to let us know what articles you would like to see in future issues. To be placed on the mailing list, or to receive extra copies, please contact:

Vermont Agency of Natural Resources
Dept. of Environmental Conservation
Water Quality Division
Lakes and Ponds Section
103 S. Main Street, 10 North
Waterbury, VT 05671-0408
(802) 241-3777

**NEWSLETTER STAFF**
Amy Bentley Picotte, Editor
Ann Bove
Susan Warren

**CONTRIBUTORS**
Amy Bentley Picotte
Holly Crosson
Michael Hauser
Neil Kamman
Rick Levey
Deb Parella
Susan Warren

**ARTWORK**
Amy Bentley Picotte
Ann Bove
Deb Parella
Susan Warren



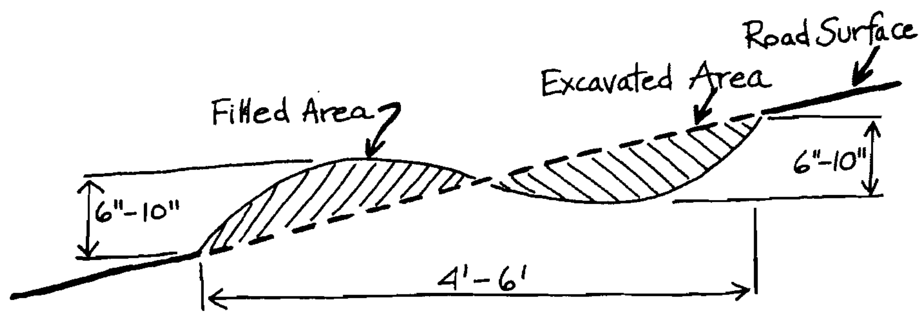
## Backroads *(continued from page 1)*

pollution source to nearby water! There are actions that shoreline residents can take to properly maintain their private roads and driveways, protect water quality, and save money.

Soil is eroded from exposed ground surfaces, such as roads and ditches, when rain or snow melt loosen particles and carry them downhill. Ground surfaces protected by vegetation and a duff layer do not usually erode. Erosion potential increases as the **volume and velocity** of runoff increases. Indications that erosion is occurring include: turbid (muddy) streams during rainstorms; gullies and sinkholes in road surfaces; sloughing banks; fine silt and sand accumulation in an otherwise rocky stream; and sediment delta build-up in lakes near inlets.

**The four *Principles of Better Backroads* are discussed below.**

**1. Get water off the road surface as soon as possible.** Avoid allowing water to run lengthwise down a road by creating a proper crown on the road surface. A road that drains directly to the sides and into vegetation is ideal as it avoids increasing the volume of water draining to a single spot in a ditch. On steep sections, waterbars can help move water off to the side of the road at regular intervals. Use of good surface gravel material, usually "crusher run" gravel (a mixture of different size particles), will help prevent erosion of the road surface because it packs firm and sheds water instead of absorbing it.

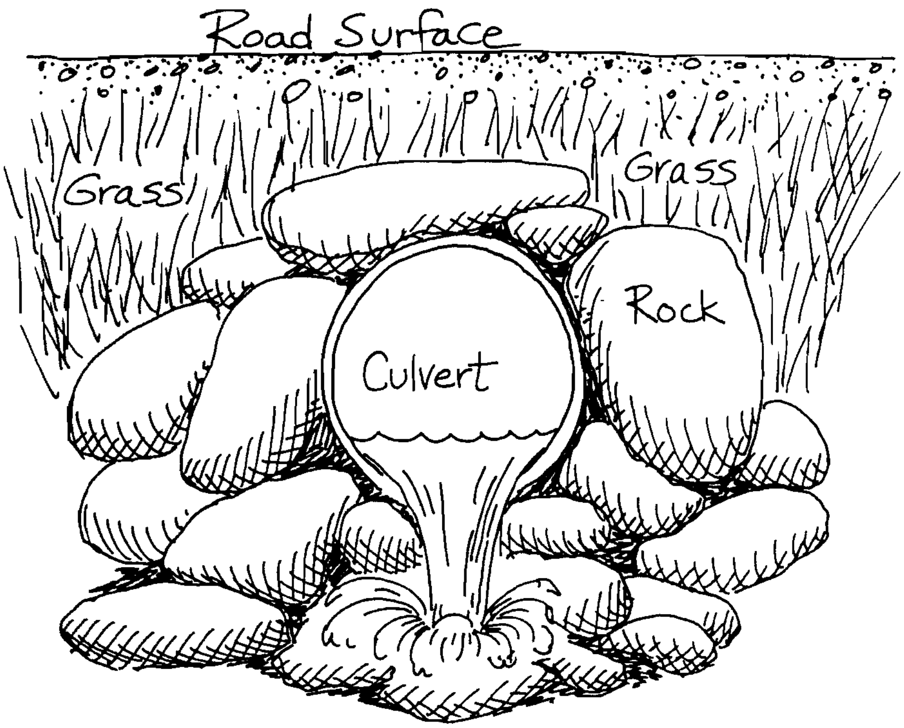



**Waterbar:** Construct crossways on a slope, angled downhill, to direct runoff from the road into a vegetated area. Steep sections require deeper and more frequent waterbars.

**2. Stabilize and revegetate exposed areas.** Ditches, culvert inlets and outlets, and roadside banks should be well vegetated or, in the case of ditches on steep slopes, lined with crushed rock. Runoff increases in volume and velocity in a ditch, and the ditch itself must be protected from erosion. Culvert inlet and outlet areas should be stabilized with vegetation or rock walls. Roadside banks should be vegetated or, where steep, stabilized with a combination of rip-rap or walls and vegetation.

residents can get together with fellow road owners and discuss a plan to correct problem areas in an orderly way that will save maintenance money in the long run and save the lake as well!

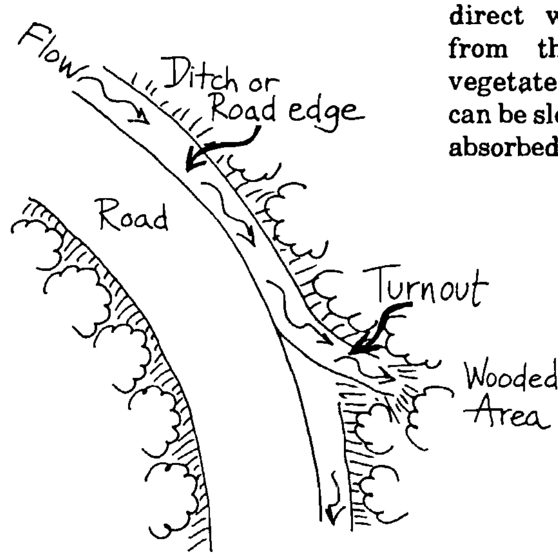
The Better Backroads Program began this past year to provide information about erosion control on municipal and private roads. For information, assistance, or a copy of the *Vermont Better Backroads Manual* describing road maintenance techniques, contact Susan Warren at 802-241-3777. Cooperating agencies have included: VTDEC, the George D. Aiken and Northern Vermont Resource Conservation and Development Areas, the Vermont Local Roads Program, regional planning commissions, Natural Resource Conservation Districts, and the Vermont Agency of Transportation.




**Culvert Header:** Protect the steep slopes adjacent to culvert inlets and outlets with stone. Less steep slopes can be stabilized with grass.

**3. Divert as much runoff as possible away from surface water.** Discharge ditch water into vegetated areas as much as possible. Use "turnouts," waterbars, and culverts to move water out of ditches and into the woods. A wooded area with a natural duff layer will filter sediment out of runoff best, and keeps turbid water from reaching streams or lakes. It can be surprising how quickly runoff disappears in a wooded area.

**4. Good maintenance will save money.** One needs to spend a little to save a lot. Lakeshore

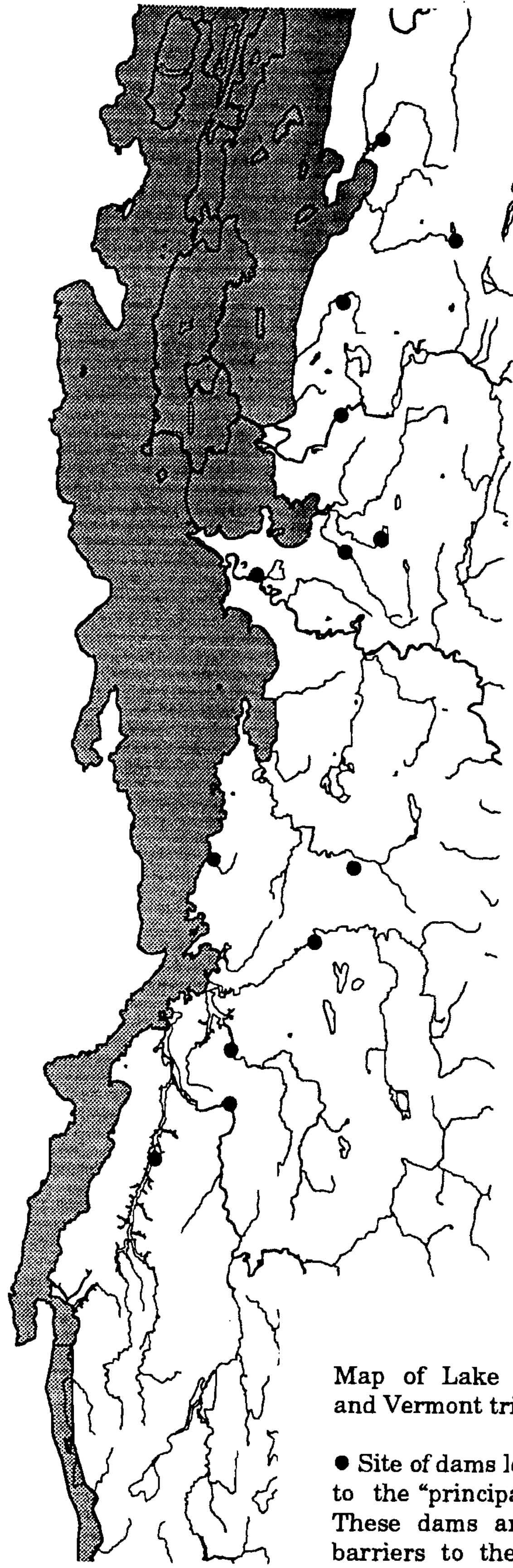



**Turnout:** Periodically direct water flow away from the road into a vegetated area where it can be slowed, filtered, and absorbed.

mussels in clusters dense enough to prevent them from feeding, moving, or reproducing. An individual mussel can be infested with up to 10,000 zebra mussels. In 1990, in Lake St. Clair, located near the Great Lakes, 100 percent of native mussels were infested with an average of more than 600 zebra mussels per individual mussel. By 1991, native mussel populations in the lake had been reduced by 99 percent!

Historically, the distribution of Vermont Lake Champlain native mussels was influenced by the "principal fall line," (a sudden drop in elevation) created by the Champlain fault and Taconic border fault. This "fall line" is generally located near the 150 foot elevational contour and has acted as a physical barrier to upstream movement of mussels. Today, several man-made dams are located along the principal fall line (see map). These dams, serving as physical barriers, continue to limit the distribution of native mussels, and should inhibit the upstream spread of zebra mussels by humans or aquatic species. The seven species that are known to occur in the Vermont Lake Champlain basin below the dams are very likely to become either extinct or rare in Vermont following the continued zebra mussel colonization of the lake.

Management actions being considered to prevent or delay the extinction of these native mussels include: establishing refuge areas within the large rivers below the dams by eliminating boat travel between designated refuge stretches and Lake Champlain; and establishing relocation areas where the threatened native mussel species can be safely placed. Actions that prevent these Vermont native mussels from becoming extinct will protect the genetic diversity of the Lake Champlain ecosystem, and help preserve it as a healthy natural resource.



Map of Lake Champlain and Vermont tributaries.

● Site of dams located close to the "principal fall line." These dams are physical barriers to the upstream migration of mussels.

In July, 1993, zebra mussels were discovered in Lake Champlain. Since then, there has been a great deal of speculation about the problems the exotic mussels could cause for the lake. There are still many unanswered questions, but there is no longer any doubt that the tiny mullosk from eastern Europe is having an impact on Lake Champlain and the people who depend upon its resources. The nuisance mussels are showing up on water intake pipes, boats, historic shipwrecks, and native mussels. Zebra mussels have reached their highest densities in the southern portion of Lake Champlain and have established growing populations throughout the lake.

Since arriving in the Great Lakes in the mid-1980s in the ballast water of cargo ships, the prolific mussel has spread rapidly through interconnected waterways. They can now be found as far south as Louisiana and as far west as Oklahoma. Zebra mussels are having substantial economic impacts and are causing numerous ecological changes, many of which are still unfolding and not fully understood.

An ongoing Lake Champlain program which monitors the microscopic zebra mussel larvae (veligers) has shown that zebra mussel reproduction has increased quite dramatically during the past year. For example, veliger densities in the South Lake in 1994 peaked at 5,000/$m^3$ (per cubic meter of water), but by 1995, densities reached 110,000 veligers/$m^3$. Further north from Thompson's Point in Charlotte, VT, to the main lake area west of Burlington, VT, veliger densities have risen from a peak of 31/$m^3$ in 1994 to 2,800/$m^3$ this year. Between Grand Isle, VT, and Rouses Point, NY, densities have reached 1,044 veligers/$m^3$, up from a high of 76 veligers/$m^3$ in 1994.

Zebra mussel veligers will typically "settle" onto a firm surface, attach, and grow into visible juvenile mussels within the course of a summer. It is at this stage that the mussels can begin to have impacts. Reports from scuba divers, state biologists, volunteer *Zebra Mussel Watchers*, and citizens have indicated that "settled" zebra mussel populations have increased dramatically, particularly in the South Lake. Different marinas have reported that several boat engines could not be started for fear that they would overheat due to obstruction of the propeller and cooling system intake port. One boat hull was reported to have been covered by a two inch thick mat of zebra mussels.

Historic shipwrecks resting on the bottom of Lake Champlain are becoming infested with zebra mussels. As predicted, infestation levels are higher on shipwrecks further south in the lake and in shallower waters (under 40 feet). The wreck of the *Champlain II* north of Westport Basin Harbor, VT, has about 20 percent coverage. Several shipwrecks belonging to the *Underwater Historic Preserve* system are also being affected. The Diamond Island Stone Boat off of Kingsland Bay, VT, has approximately 30 percent coverage on parts of the wooden structure and the rock cargo. Zebra mussels are also present on the *General Butler* wreck near Burlington. The Coal Barge, Horse Ferry, and the *Phoenix*, which are all in deeper water (45-110 feet), did not have any attached zebra mussels when they were last checked in September, 1995.

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## Zebra Mussels *(continued from page 5)*

Unfortunately, there are no feasible methods for removing zebra mussels from an infested waterbody, especially one the size of Lake Champlain. Therefore, the only way to reduce the effects of zebra mussels is to keep the public informed about the potential impacts and proper spread prevention methods. Additional information can be obtained by calling the VTDEC at 802-241-3777, or the Lake Champlain Basin Program at 1-800-468-5227.

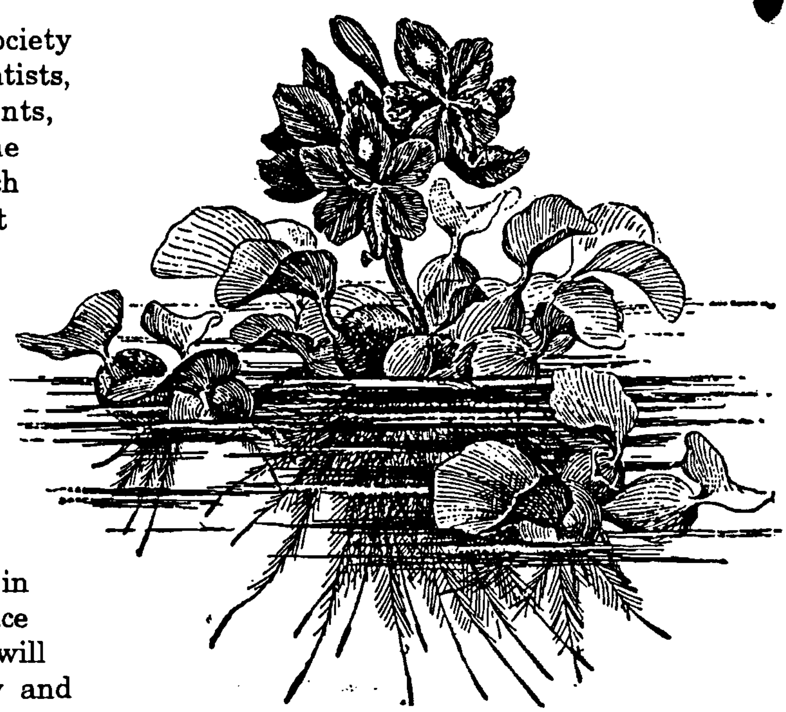
### Economic Impacts on Water Supply Systems

The biggest economic impact that zebra mussels have had thus far in the Lake Champlain Basin has been shouldered by community and municipal water facilities and industries that draw water from the lake. Although total costs are still being tallied, each of the facilities has already spent thousands of dollars installing control devices and thousands more to operate and maintain the systems. Fortunately, most facilities were prepared for the zebra mussel's arrival and should not experience heavy infestations that could ultimately cost much more to correct.

Lakeshore camp and homeowners who draw water directly from Lake Champlain are advised to install some sort of control device to protect their plumbing systems from zebra mussel infestation. Protecting plumbing systems before they have problems will likely be less expensive in the long-run than having to disinfect or repair them later on.

## Aquatic Plant Management Society Is Coming to Burlington, Vermont!

The Aquatic Plant Management Society (APMS) is an international organization of scientists, educators, students, administrators, consultants, and concerned individuals interested in the management and study of aquatic plants. Each year APMS holds a meeting to present the latest developments in the field of aquatic plant science and aquatic plant management using biological, mechanical, and chemical techniques. The Society was founded in 1961 and has chapters in the southern, western, and midwestern U.S., which is where its meetings have traditionally been held.



For the first time in the history of the society its annual meeting will be held in New England! Better yet, it is being held right here in Burlington, Vermont! The meeting will take place July 14-18, 1996, at the Radisson Hotel. There will be lots of current information on the biology and control of some of the most troublesome exotic wetland and aquatic plants in New England, including Eurasian watermilfoil, water chestnut, and purple loosestrife. Plan now to attend this meeting and take advantage of the extraordinary opportunity to tap into the national expertise that will be available at this event! For more information, please contact Holly Crosson at 802-241-3777.

## EPA Weevil Project Draws To A Close

The summer of 1995 was the last year for weevil research under the Environmental Protection Agency (EPA) biological control research grant project that was started in 1990. This program gathered a wealth of information on the life history of the native weevil, *Euhrychiopsis lecontei*, its abundance and distribution in Vermont lakes, and the feasibility of using it to control Eurasian watermilfoil in Vermont. The EPA grant officially terminated in September of 1995.

During the summer of 1995, the weevil crew continued to rear and introduce weevils; however, their efforts were also directed toward public education and conducting surveys. The crew surveyed lakes to further define the distribution of weevils and assess the condition of milfoil in some lakes known to have weevils. The most noteworthy result of the 18 surveys completed was the discovery of a significant milfoil decline on Arrowhead Mountain Lake in Milton and Georgia. Although the VTDEC was aware that a natural population of weevils had been present in the lake since at least 1990, a 1994 plant survey showed that milfoil occurred in several very dense patches at the southern end of the lake. This area had been targeted to receive weevils as part of the biological control project. The drastic milfoil decline in the southern milfoil beds between 1994 and 1995 caused the VTDEC to cancel weevil introductions to Arrowhead Mountain Lake. It is believed that the weevils already present in the lake played a role in the milfoil decline.

*Photo taken by Ted Walker*

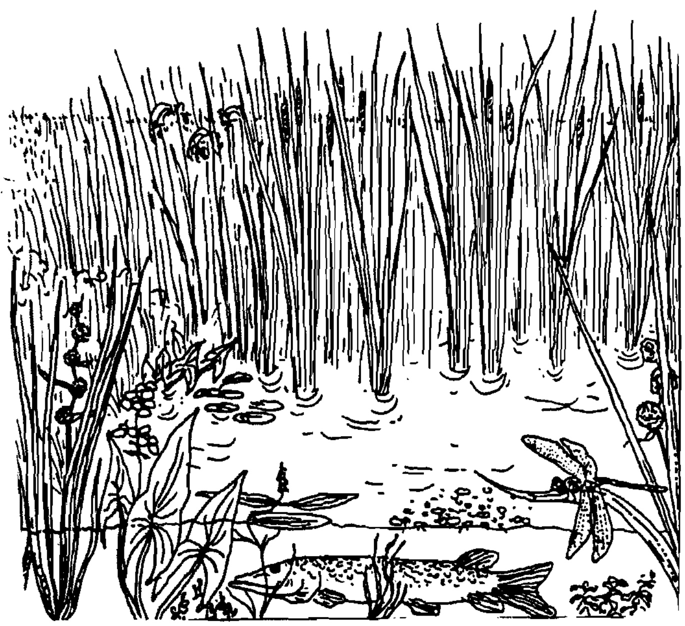
Weevil introductions took place on two waterbodies during the summer: Sunrise Lake in Benson and Orwell and a small pond in Charlotte. A total of 2,717 weevil adults, eggs, larvae, and pupae were released. In addition to these introductions, the crew met with lake users from Lake Iroquois, Sunrise Lake, and a pond in St. Albans to help them get set up so they could rear weevils on their own in home aquariums. A teacher from the Lake Fairlee area met with the crew to get some tips on how to rear weevils in his school classroom. The idea behind this part of the program was to give interested people an opportunity to learn about weevils first-hand and to be able to see how great an impact the weevils can have on milfoil plants. Most participants were supplied with an aquarium tank and weevils, and were given instructions on rearing procedures. It is not expected that large numbers of insects will be reared in this educational effort. However, under an Aquatic Nuisance Control Permit issued in July of 1995, lake residents were authorized to place their reared weevils into the lake or pond.

The VTDEC believes weevils do hold some promise for Eurasian watermilfoil control in Vermont. Unfortunately, additional EPA or other federal funds are not available at this time to continue the weevil project. It has not yet been determined whether state funds will be available to conduct a scaled down version of the program in future years.

# Low-Cost, Effective Lake and River Monitoring For School Groups

Education is progressing beyond learning primarily from worksheets, papers, and pencils, toward using activities that involve models, games, and simulations, to even using teaching strategies that encourage student participation in community issues. Many teachers involved in interdisciplinary school programs have expressed interest in investigating the condition of a local river or lake but are not exactly sure how to start such a project. One, low-cost, effective method for students to monitor a local river or lake simply requires using observational skills, a shoreland map, a tape measurer, and a clipboard.

An educational program that is most successful ensures that new knowledge will be learned and, most importantly, acted upon. The objectives for students to study a river or a lake should be clearly defined and stated such that students are challenged to think at high cognitive levels, which includes being able to apply their new knowledge. For example, a class lake study project with the objectives to identify physical lakeshore characteristics, evaluate the condition of the lake, and devise a community lake protection plan requires students to collect data, interpret it, and to put it to use. Students involved in studying a lake with the ultimate objective of actually trying to protect it are able to make two important connections: first, how the new knowledge relates to their past experiences; and secondly, how people's actions in the watershed, including their own, affect surface water quality.



*Drawing by Libby Walker Davidson*

In Vermont, the biggest cause of surface water quality problems comes from sediment and nutrient nonpoint sources of pollution. The primary nonpoint sources of water quality pollution are caused by agricultural practices and rural development (new construction, gravel roads, and personal property practices). The sediment and nutrient run-off from these sources alters stream life such as fish and macroinvertebrates and can lead to stream impairment. Lakes and ponds suffer from an increase in the nutrient loadings caused by nonpoint source pollution. Excessive nutrients stimulate plant and algae growth, creating unfavorable recreational conditions and increased biological productivity (more simply stated as causing the lake or pond to age at an unnaturally fast rate). Students can detect these harmful lake and river problems by simply using observational monitoring techniques.

Many teachers and community groups often plan a lake or river study unit around purchasing and obtaining expensive test kits for water quality monitoring. Although these kits, when used properly, can often reveal a lot about the chemical composition of a water body, there are some concerns about the educational and practical value of their use. For example, when students use these kits and start to record data, such as 35ug/l (micrograms per liter) of total phosphorus or 26ug/l of nitrates, will they or their teacher then be able to interpret this data? Does the chemical data teach the students anything about the body of water, or did the students just learn how to operate an expensive piece of water testing equipment? Collecting chemical water quality data is easy, but evaluating it and putting it in perspective requires comparative studies, research, repetitive sampling, and data management, not easy tasks for a school group with limited time.

## What Is Observational Monitoring, and How Can It Be Used To Evaluate The Conditions of a Lake or Stream?

Stream or lake observational monitoring entails surveying and recording the waterbody's physical features. If a checklist is used to note the physical conditions, then the observational monitoring tends to be qualitative. However, if students decide to calculate the slope of the shoreland bank, the number and size of shoreland trees, or the width of the buffer strip, then quantitative data is collected. Methods to collect qualitative or quantitative data can involve either a scoring system, like using a rating from 1-20, or a percentage system, such as measuring or estimating the percent of a specific physical characteristic in a certain area.

When students study a river or a lake by observational monitoring, they are collecting sound information to help evaluate the condition of terrestrial and aquatic animal habitat, the general health of the waterbody, and actions to take that can better protect the water quality. The following list includes some of the important lake or river physical features, and separates them into two groups; in-lake/in-stream indications and potential sources of water quality problems.

### In-Lake/In-Stream Indications of Water Quality Problems

**Water Clarity**

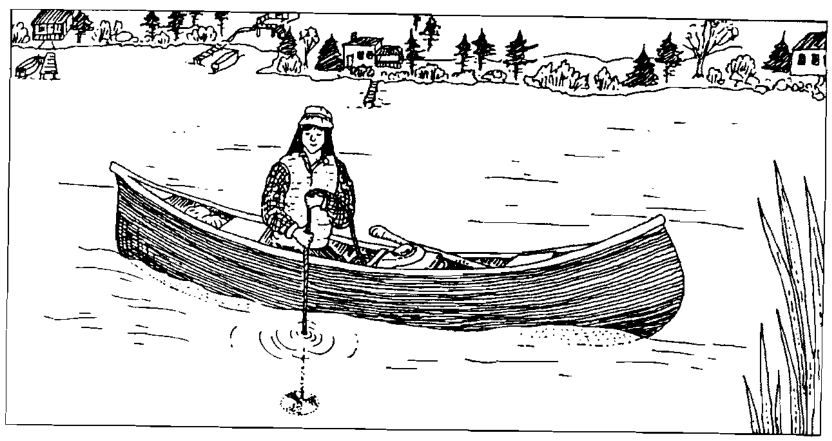
*Definition:* the transparency of the water, how far through the water one can see. In lakes, water clarity is measured with an eight inch Secchi disk. The disk, attached to a rope, is lowered from the surface down to the point where it disappears. The rope, marked in meters, is read for how far down the disk was seen, which gives the water clarity reading. Turbidity is a measurement of the clarity of water, and is influenced by the presence of suspended solids in the water. Suspended solids are varied ranging from clay, silt, and plankton, to industrial wastes and sewage.

*Significance:* Water clarity is related to how much material is suspended in the water column. In lakes with high nutrient levels, algae and other organisms that feed on these nutrients will be more prevalent, causing poorer water clarity readings than in a lake with low nutrients and little biological growth. High turbidity diminishes light penetration and influences the amount of light available for plant and algal growth.

**Inlet Area of Lake**

*Definition:* the site where a tributary stream flows into a lake.

*Significance:* inlet areas covered by a lot of sand, sediment, or plant growth, indicate that somewhere up along the tributary stream erosion or nonpoint source pollution is occurring. The sediments and nutrients are washing into the stream and then transported and deposited into the lake. An increased nutrient supply accelerates the aging process of the lake.



*Drawing by Libby Walker Davidson*

**Visible Stream or Lake Bottom**

*Definition:* the substrate area of a stream or lake that you can observe from the water's surface.

*Significance:* The bottom composition of a lake can vary along different areas of the lake. In general, signs of potential problems may be bottom growing slimes (benthic algae), or excessive plant growth coverage. Since plants and algae feed on the available nutrients, when the nutrient supply increases, it can lead to excessive plant growth. The type of river bottom: bedrock, rocks, gravel, sand, or silt is determined in part by the current velocity and by the underlying geology of the area. The degree to which boulders, rubble, or gravel are surrounded by silt or sand (percent embeddedness), indicates whether or not there is suitable habitat for macroinvertebrates, fish spawning, and egg incubation.

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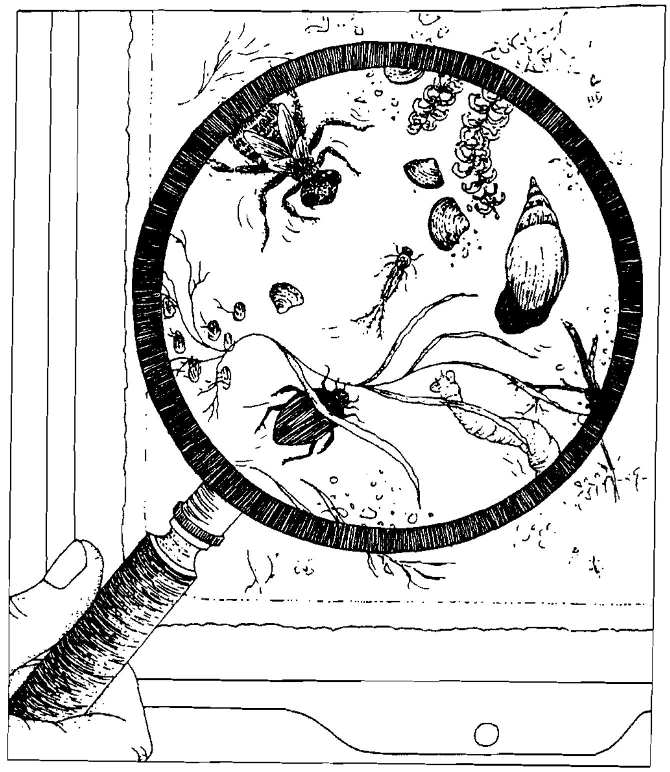
### Macroinvertebrates

*Definition:* animals lacking in internal skeletons that are large enough to see with-out a microscope, such as insects, clams and snails, and crayfish.

*Significance:* Macroinvertebrates are very sensitive to changes in the physical and chemical nature of their habitat and serve as excellent indicators of the overall environmental quality of a river or lake. Macroinvertebrate communities contain many organisms, each with its own preferred environmental conditions. The structure of this complex community, the type and abundance of organisms found, reflects the physical and chemical conditions of the water. In general, unpolluted waters support a diverse and species-rich macroinvertebrate community. Under conditions of pollution stress (nutrient enrichment, toxic pollutants) and physical habitat degradation, (flow alterations, silt and sand sedimentation, removal of shoreline vegetation) the more sensitive species will decline in abundance, while the more tolerant ones will increase.



*Drawing by Libby Walker Davidson*

## Potential Sources of Water Quality Problems

### No Bufferstrip

*Definition:* vegetative areas between a lake, stream, or wetland and human activity.

*Significance:* Bufferstrips stabilize shoreland, preventing erosion, filter out sediments, nutrients, and pathogens from nonpoint source runoff, provide shade for the aquatic organisms, and are wildlife habitat. A shoreland with no bufferstrip offers none of these beneficial functions.

### Nearby Gravel Roads

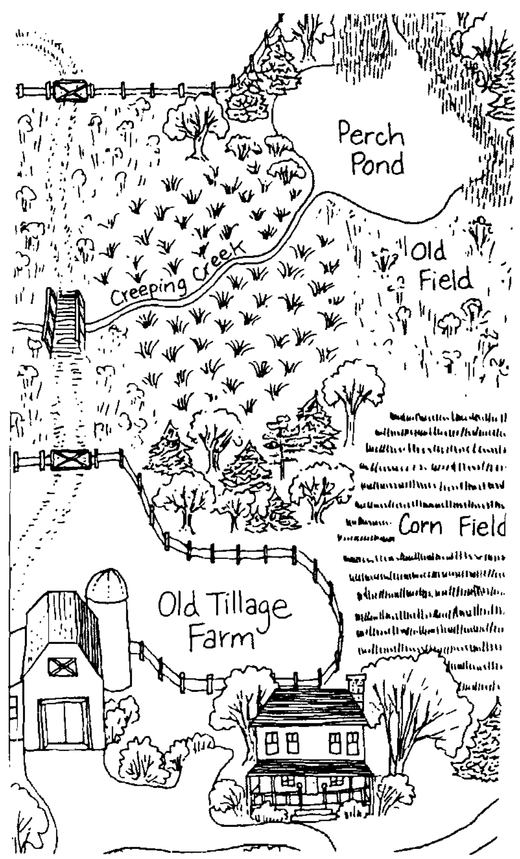
*Definition:* pathways used for vehicle and pedestrian passage.

*Significance:* Gravel roads can be a large contributor of nonpoint source pollution to rivers and lakes. Gravel roads maintained regularly and properly can reduce soil runoff to rivers and lakes.

### Neighboring Farms

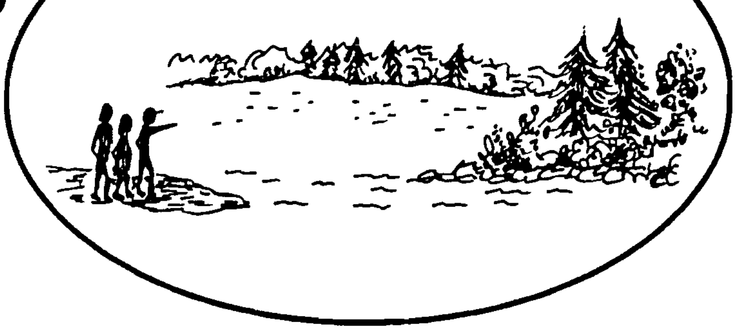
*Definition:* the home for horses, sheep, cows, and other animals used in agricultural practices.

*Significance:* farms are another potential source of nutrient and sediment loadings to rivers and lakes. Farms that follow the Accepted Agricultural Practices are less likely to have excessive run-off and be the cause of water quality problems.




*Drawing by Libby Walker Davidson*

# State of the Lakes



## The Lake Protection Classification System:
### how it is used to identify and prioritize lakes for protection activities

In past *Out of the Blue* issues, readers have become acquainted with some of the various monitoring programs VTDEC uses to detect changes in lake water quality. Results from these monitoring programs are also incorporated into the Lake Protection Classification System, which is used to identify lakes in need of protection-related efforts. This new classification system has been designed to rank individual lakes for protection efforts by scoring every 20-acre or larger waterbody in Vermont along three protection classes. These classes, **Unique**, **Threatened**, and **Vulnerable**, are themselves made up of four or five individual categories. For each category, lakes are scored on a scale of zero to ten, and these individual scores are summed to make up the class score. Hence, lakes with the highest scores in any given class would have the highest priority for protection activities related to that class. The three classes and their constituent categories are discussed below.

Lakes are considered **Unique** for a variety of reasons. True *wilderness* lakes (lakes with only foot access and very limited watershed development) are unique in Vermont. Accessing one of Vermont's wilderness lakes, which offer a Thoreau-like quality of solitude and beauty, requires exerting physical effort. *Ultra-oligotrophic*, or lakes with extremely clear water, which are defined as having a mean spring total phosphorus concentration of 6ug/l (micrograms per liter) or less, are also considered unique in Vermont. Finally, lakes are considered unique if they support *rare*, *threatened*, or *endangered species*, or if they have unusual and uncommon *scenic and natural features* (cliffs, bouldered shorelines, or especially uncommon, natural shoreline vegetation).

Threatened lakes are evaluated based on the current existing threats to lake water quality. A common threat to many Vermont lakes is *accelerated eutrophication* (nutrient enrichment). Other threats for which lakes are scored include: proximity to an *Eurasian watermilfoil-infested* lake or the presence of a controllable quantity of this invasive weed; the ability of the lake to *accept and buffer acid rain*; presence of *toxic substances*; and threat by *zebra mussels*.

Finally, the Vermont lakes that are judged to be **Vulnerable** are lakes which score high in one or more of the following characteristics and can be susceptible to rapid water quality degradations. A *transitional phosphorus* concentration of 14 to 16ug/l indicates that a lake is on the threshold of becoming eutrophic. Other indications that a lake is vulnerable to change include: *inadequate zoning regulations* to protect water quality; *critically low dissolved oxygen*, which can result in fish kills and blue-green algal blooms; or the presence of *metalimnetic algae*, which indicates

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## Classification (*continued from page 11*)

a potential imbalance in the nutrient dynamics of a lake.

The process by which the individual categories are scored has been automated in the Lakes and Ponds Data Management System, such that each year, new lake water quality monitoring results will be reflected in updated lake protection scores. At any time, VTDEC staff can call up a single computer screen, which displays the current scoring for the three protection classes for any given lake. The lakes which score highest overall make up the "short list" of lakes that need immediate attention. The Lake Protection Classification System allows VTDEC staff to direct their efforts and resources in an efficient and effective manner.

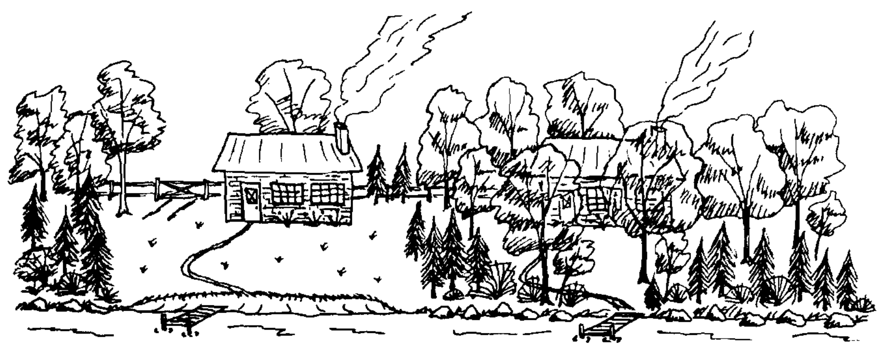
Among others, the following large recreational lakes, Lake Carmi, Harveys Lake, and Lake Parker have been identified by the Lake Protection Classification System as threatened lakes with respect to eutrophication-related issues. The different lake associations, which act as stewards to these lakes, have all begun efforts with the VTDEC's Lake and Watershed Survey Program to identify local nutrient sources as a first step toward better protecting the lake. For more information on this newly developed classification system, contact Neil Kamman at 802-241-3777.

## From Drought To Deluge: How Buffer Strips Help Protect Water Quality

1995 was a super summer to spend at a favorite swimming hole. Consistent hot and dry weather encouraged a lot of recreation on lakes and rivers. After a drought-ridden summer, farmers in particular began to celebrate as the overdue rains finally arrived in August. But, when the rains proved relentless in northern Vermont, the good news turned to bad. The extreme weather patterns of last summer, from drought to deluge, greatly affected agricultural production, food supply for wildlife, and took its toll on the quality of surface waters.

When the rain came, it fell hard and fast onto a parched, impermeable earth, resulting in rapid and high runoff to rivers and lakes. For those who live in areas where the August flood wreaked greatest damage, it was easy to witness some examples of the role that buffer strips played in protecting the water quality. Buffer strips, vegetative shoreland areas, filtered out major debris that was being carried down to the rivers and lakes, such as logs, hay bales, and trash. Buffer strips also helped stabilize the banks with their root systems. Where buffer strips had been cut away from sections of a river or a lake, shorebanks literally caved in and eroded away, adding nutrients and sediments to the water and, in some locations, forever changing the path of the water.

Buffer strips are incredibly valuable to the protection of surface water quality. During times of drought, buffer strips offer shade to aquatic organisms and keep the water temperatures cooled. Unfortunately, too many shores have been cleared of their buffer strips, and consequently those areas and the neighboring lands are vulnerable to flood damage. Some erosion will naturally occur under severe storm conditions. However, shorebanks with buffer strips are less likely to have erosion problems, and are better equipped to help protect the water quality.



## Winter Tracking of a River Otter

Several winters ago I was exploring the swamp surrounding Malletts Creek in Colchester when I came across an interesting set of tracks. The water in the creek and surrounding swamp was frozen solid and dusted with a fine layer of snow. In the winding ice channels I noted diagonal pairs of rather large prints having five webbed toes with claws at the tips. After following these tracks a short distance I came across the clue that gave away their identity, a long trough-like slide eight to ten inches wide that continued for six to eight feet across the frozen ice. This track was not just from a playful creature making its way across the landscape, but from a smart one, who took advantage of the conditions to travel quickly and efficiently. It was my first meeting with the river otter, *Lutra canadensis.*

River otters are members of the weasel family, Mustelidae, which includes mink, fisher, ermine, and skunk. They are long bodied animals with short legs ranging in size from three to four feet long (not including their tail), and weighing from ten to thirty pounds. They have thick, dark brown, oily fur, a lighter underbelly, and a white throat. On land they move by bounding, in which the forefeet move together and the hind feet land exactly in the tracks made by the forefeet. Sliding is an important and efficient form of movement for these low-slung animals and they use it both for going down and up hills.

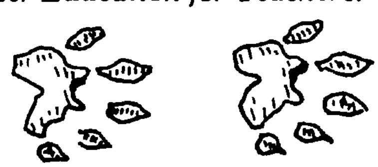
As I followed the tracks that day I saw piles of black scat filled with fish scales marking prominent spots along the water's edge. This otter could have been out making the rounds throughout its home range, which can vary from 12 square miles in females with young, to over 60 square miles in mature adult males. On land otters use these scent markers to identify territory and as a form of communication with other otters in the area.

Otters are always found close to water as that is where they feed and have the greatest mobility. In winter the otter's diet consists mostly of fish, but in summer they also consume frogs, snakes, turtles, insects, and crayfish. They hunt where there is the greatest concentration of nutrients to support these smaller water animals: along the shallow edges of lakes, lake outlets, or where streams flow into lakes. They use their keen eyesight to locate and chase after their prey, swimming beneath them so they are backlit from above. They maneuver through the water with their large webbed feet and use their thick tail for propulsion. Their sensitive forepaws and whiskers allow them to quickly and accurately locate their prey at close range, which they then catch with their teeth. They also nuzzle along the lake or river bottom using their sensitive whiskers to find food hiding there.

Keep your eyes open for otter and their tracks this winter, and you may be lucky enough to see one too!

- Deb Parrella

*You can also look for the "Water Otter" to learn more about upcoming VTDEC educational offerings concerning Vermont's water resources. The river otter is the logo for Vermont Project WET, Water Education for Teachers.*



## The 1995 Great All-American Secchi Dip-In

During the week of July 4, 1995, monitors participated in a national Secchi disk transparency event. More than 1,800 volunteers in 37 states and two provinces of Canada gathered Secchi disk transparency data. Bob Carlson, the national coordinator of the event from Kent State University in Ohio, asserts that this project helped explain the condition of the nation's lakes and reservoirs, earned recognition of volunteer monitoring efforts, and gave volunteer monitors a sense of national purpose. The event was sponsored by the U.S. Environmental Protection Agency and the North American Lake Management Society.

Forty Vermont Lay Monitors were able to take a Secchi disk reading during the required time period and fill out the accompanying survey questions on water quality perception. Many thanks to all those Lay Monitors who did participate in the Great All-American Secchi Dip-In during the first year of this national event!

As Bob Carlson explains, preliminary results from the survey suggested that volunteers in areas where the transparency was low were as likely to think of their water quality as good as would someone in a region of high transparency. The reasons for these regional differences in perceptions of quality are complex and are not necessarily based on monitors choosing criteria other than Secchi disk readings to evaluate water quality, nor simply because people become accustomed to their environment. Perhaps as this event continues annually, there will be a clearer understanding of why these differences in water quality perception exist. One final very important and interesting point learned from this national event is the need to give more consideration to "user perceptions" when making water resource management decisions. (More detailed results are available by writing Bob Carlson, Great American Secchi Dip-In, Department of Biological Sciences, Kent State University, Kent, Ohio 44242.)

**The table below lists a summary of the 1995 Secchi disk readings (SD) taken in meters, the states that were involved, and the number of participants from each state.**

| State | Avg. SD | Max. SD | Min. SD | Participants |
|---|---|---|---|---|
| AK | 6.51 | 16.4 | 0.60 | 10 |
| AL | 1.03 | 1.95 | 0.35 | 20 |
| CT | 4.75 | 4.75 | 4.75 | 1 |
| DE | 0.99 | 1.63 | 0.28 | 3 |
| FL | 1.87 | 6.55 | 0.33 | 138 |
| GA | 2.96 | 3.40 | 2.01 | 5 |
| IA | 0.78 | 1.98 | 0.28 | 4 |
| ID | 5.11 | 8.00 | 2.22 | 2 |
| IL | 1.01 | 4.38 | 0.25 | 67 |
| IN | 2.18 | 5.79 | 0.46 | 48 |
| KS | 1.13 | 7.09 | 0.13 | 23 |
| KY | 1.26 | 1.75 | 0.76 | 4 |
| LA | 0.03 | 0.03 | 0.03 | 1 |
| MA | 3.19 | 14.7 | 0.49 | 19 |
| MD | 1.03 | 1.70 | 0.58 | 6 |
| ME | 5.73 | 15.2 | 0.17 | 115 |
| MI | 4.14 | 11.2 | 1.68 | 30 |
| MN | 3.24 | 22.8 | 0.15 | 501 |
| MO | 2.00 | 2.31 | 1.69 | 2 |
| MT | 5.98 | 16.4 | 1.19 | 31 |

| State | Avg. SD | Max. SD | Min. SD | Participants |
|---|---|---|---|---|
| NB | 12.2 | 15.9 | 8.50 | 2 |
| NC | 0.98 | 4.50 | 0.40 | 17 |
| NE | 1.08 | 3.84 | 0.03 | 32 |
| NH | 5.14 | 13.0 | 0.50 | 101 |
| NJ | 0.84 | 2.44 | 0.15 | 15 |
| NY | 4.02 | 14.5 | 0.91 | 50 |
| OH | 0.94 | 2.92 | 0.13 | 63 |
| OK | 0.52 | 1.92 | 0.17 | 8 |
| OR | 3.99 | 6.75 | 1.07 | 11 |
| PA | 1.37 | 1.98 | 1.00 | 5 |
| PEI | 1.25 | 1.75 | 0.75 | 4 |
| RI | 2.52 | 7.30 | 0.20 | 46 |
| SC | 3.38 | 4.99 | 1.05 | 35 |
| TN | 0.69 | 0.69 | 0.69 | 1 |
| TX | 0.89 | 6.00 | 0.20 | 19 |
| VA | 0.70 | 2.30 | 0.07 | 33 |
| VT | 5.71 | 12.0 | 0.70 | 40 |
| WA | 4.04 | 7.92 | 1.02 | 48 |
| WI | 3.04 | 8.53 | 0.15 | 338 |

## Happenings

**Project WET,** Water Education for Teachers, Workshops Sponsored by the VTDEC, Water Quality Division. Call Deb Parrella or Amy Picotte at 802-241-3777 to schedule hosting a workshop in your community, or to find out when and where workshops have been scheduled for the winter-spring of 1996.

PROJECT WET
Water Education for Teachers

**Aquatic Plant Management Society Annual Meeting**

**DATE:** July 14-18, 1996
**PLACE:** Radisson Hotel, Burlington, VT
**CONTACT:** Holly Crosson
VTDEC Water Quality Division
Lakes and Ponds Section
103 South Main St. 10-N
Waterbury, VT 05671-0408
802-241-3777

★Please see page 6 for more information about this event.

## Recently Made Available

**Vermont Agency of Natural Resources**
**Educators' Guide**
**Natural Resources Education Materials 1995-96**

The *Educators' Guide* is a listing of educational programs and materials that ranges from those developed in and pertinent to Vermont to those which are nationally recognized. It is a free publication, available by contacting the Lakes and Ponds Section.

## Lake Lingo

***Diatoms-*** a group of algae which use silica to form glass shells for support and protection; usually dominant in lakes during springtime.

***Duff Layer-*** a soft, spongy, ground covering of decaying plant materials, which protects soil from erosion and filters sediment from run-off.

***Plankton-*** small, usually microscopic, plants and animals, found suspended in water.

***Quantitative-*** a method to describe something using numbers.

***Qualitative-*** a method to describe something using its characteristics.

## It's True

What do a loaf of bread, a sheet of paper, and an automobile have in common? Water! People use water for direct and indirect purposes. Direct purposes include bathing, drinking, and cooking. Indirect water uses include the large quantities of water needed to grow grains for our bread, to process wood for making our paper, and to produce steel used in the automobiles we drive.

The needs and interconnectedness among water users make water conservation issues very complex. Manufacturers use less water by incorporating recycled materials into their products or by recycling water within their factories. For example, producing a ton of recycled paper uses 60,000 gallons less water than producing a ton of virgin paper! Individuals who conserve water and energy and use recycled products support the efforts of conscientious manufacturers and farmers, ensuring the availability of water for all water users.

(This information is provided by *Water Works*, an educational activity from Project WET's Curriculum and Activity Guide. The VTDEC Water Quality Division sponsors Project WET, Water Education For Teachers. Project WET workshops are being held throughout the state to introduce educators to interdisciplinary, hands-on activities focusing on people and their relationship to water.)

**From all of us at the Lakes and Ponds Section, we wish you a very happy and healthy New Year!**

**Vermont Agency of Natural Resources**
**Department of Environmental Conservation**
**Water Quality Division**
**Lakes and Ponds Section**
**103 S. Main Street, 10 North**
**Waterbury, VT 05671-0408**

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